

PATENT ABSTRACTS OF JAPAN

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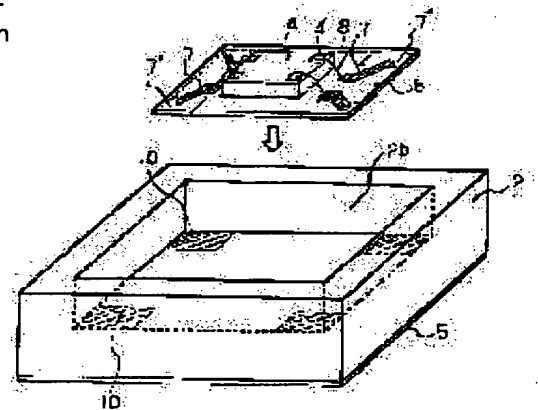
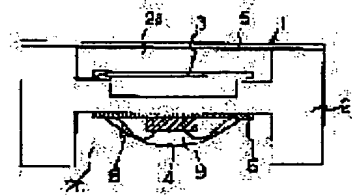
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(54) PIEZOELECTRIC OSCILLATOR

(57)Abstract:

PROBLEM TO BE SOLVED: To eliminate the need of excessive heating and pressure force, to improve reliability with respect to shock resistance, to reduce cost and to realize miniaturization by fixing a printed board loading a semiconductor element into the recessed part of a ceramic container.

SOLUTION: A crystal oscillator 1 is provided with a ceramic container 2 having recessed parts 2a and 2b on upper/lower confronted faces which are formed for realizing miniaturization by narrowing a parts loading area, a crystal element 3 and a semiconductor element 4. Wiring patterns are installed in the recessed parts 2a and 2b in the ceramic container 2. The crystal element 3 is loaded in the recessed part 2a so that it is electrically connected to a wiring pattern. Then, the container is airtight-sealed by a cover 5. Even if a printed board 6 is thin, a whole lower face is closely brought into contact with a hot plate 9 at the time of wire-bonding the board to the semiconductor element 4 in the crystal oscillator 1 of such constitution, inconvenience does not occur and excessive heating is not required even if large pressing force and ultrasonic energy are added.



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CLAIMS

[Claim(s)]

[Claim 1] The piezo oscillator characterized by constituting so that said printed circuit board in which was equipped with the piezoelectric device, the semiconductor device, the printed circuit board, and the ceramic container that prepared the cavity for containing these, and said semiconductor device was carried may be fixed in said cavity.

[Claim 2] The piezo oscillator characterized by containing the printed circuit board which carried said semiconductor device in said cavity of another side while having the piezoelectric device, the semiconductor device, the printed circuit board, and the ceramic container that prepared the cavity for containing these in each front rear face and containing said piezoelectric device in said one cavity.

[Claim 3] The piezo oscillator according to claim 1 or 2 characterized by said semiconductor device being connected by wire bonding or FIRIPPU chip mounting on said printed circuit board.

[Claim 4] The piezo oscillator according to claim 1 to 3 characterized by said printed circuit board being a flexible sheet, a ceramic substrate, or a glass epoxy system substrate.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] About a piezo oscillator, especially this invention is reliable and relates to a low price piezo oscillator.

[0002]

[Description of the Prior Art] In recent years, with the miniaturization of communication equipment, the source of a reference signal used for this is asked for a small thing, and the crystal oscillator of structure as shown in drawing 3 is proposed in it. This drawing (a) shows the side-face cross-section block diagram for explaining the wire bonding process that this drawing (b) can set the final drawing of the conventional crystal oscillator like the assembler of the crystal oscillator, respectively. As shown in

this drawing (a), a crystal oscillator 100 is equipped with the ceramic container 101 which has Cavities 101a and 101b at each front rear face which counters, the Xtal component 102 contained to each cavity, and a semiconductor device 103 in order to realize the miniaturization by *****-izing of element-placement area.

[0003] A circuit pattern (not shown) is prepared in this ceramic container 101 inside [each] cavity 101a and cavity 101b, the Xtal component 102 is carried in the condition of having connected with the circuit pattern electrically, in cavity 101a, and further, while a semiconductor device 103 is laid in cavity 101b, the electronic circuitry of a semiconductor device 103 and the circuit pattern of cavity 101b are electrically connected by the metal wire 104. In addition, 105 shown in this drawing is a lid for carrying out the hermetic seal of the cavity 101a, and 106 is potting resin for protecting a semiconductor device 103 and the metal wire 104 further.

[0004] In case bonding of the metal wire 105 is generally carried out, a wire is connected to a necessary location by forcing a capillary tube 108 on a bonding location, where it carried the ceramic container 101 on the hot plate 107 and a semiconductor device 103 and the ceramic container 101 are heated, but in this case, even if it makes thrust of a capillary tube 108 small, it is common to add ultrasonic energy to a capillary tube 108 so that wire bonding can be performed more effectively.

[0005]

[Problem(s) to be Solved by the Invention] However, with the above configurations, when the thickness of the ceramic plate 109 with which the circuit pattern shown in this drawing (b) was formed becomes thin, there is a possibility that a ceramic substrate 109 may be damaged by slight thrust. In addition, since distribution of the thrust by bending arises even if it is the case where the ceramic plate 109 can bear a certain amount of thrust, if thrust is increased so that this may be compensated, breakage may arise to the ceramic plate 109. therefore, extent which breakage does not produce anyway -- thrust -- small -- not carrying out -- in order not to obtain, but to compensate the insufficiency of the energy produced by this and to acquire the proper sticking-by-pressure force, whenever [by the hot plate 107 / stoving temperature] needed to be raised fairly.

[0006] However, although whenever [stoving temperature / in the case of wire bonding] is generally set as the range of 150 degrees C to 200 degrees C, by the case where become easy to diffuse an Au-aluminum system alloy in the joint of the metal wire 104 and a circuit pattern, and heating at high temperature is carried out more nearly further than the above-mentioned optimum temperature to it, diffusion of an Au-aluminum system alloy advances rapidly, so that whenever [stoving temperature] is an elevated temperature also in this temperature requirement. Therefore, the lower one of whenever [stoving temperature] is desirable as much as possible. And since the bonding strength of the metal wire 104 deteriorated with advance of diffusion of this Au-aluminum system alloy, there was a problem of becoming easy to disconnect to impacts, such as fall. In case this invention is made in order to solve many problems of the conventional piezo oscillator, and a semiconductor device is carried in a ceramic container, it aims at not needing too much heating and thrust, and excelling in the dependability over shock resistance, and offering a low price small piezo oscillator.

[0007]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, invention according to claim 1 concerning this invention is equipped with a piezoelectric device, a semiconductor device, a printed circuit board, and the ceramic container that prepared the cavity for containing these, and is characterized by constituting so that said printed circuit board in which said semiconductor device was carried may be fixed in said cavity.

[0008] Invention according to claim 2 is characterized by containing the printed circuit board which carried said semiconductor device in said cavity of another side while it is equipped with a piezoelectric device, a semiconductor device, a printed circuit board, and the ceramic container that prepared the cavity for containing these in each front rear face and contains said piezoelectric device in said one cavity.

[0009] In addition to invention according to claim 1 or 2, invention according to claim 3 is characterized by said semiconductor device being connected by wire bonding or FIRIPPU chip mounting on said printed circuit board.

[0010] In addition to invention according to claim 1 to 3, invention according to claim 4 is characterized by said printed circuit board being a flexible sheet, a ceramic substrate, or a glass epoxy system substrate.

[0011]

[The gestalt of operation of this invention] Hereafter, this invention is explained to a detail based on the illustrated example. Drawing 1 (a) is the cross-section block diagram showing one example of a crystal oscillator based on this invention, and this drawing (b) is a decomposition strabism block diagram showing the situation of loading of the semiconductor device at the time of the above-mentioned crystal oscillator assembling. As shown in this drawing (a), a crystal oscillator 1 equips the location of vertical both sides which counter with the ceramic container 2 which has cavity 2a and 2b, the Xtal component 3, and a semiconductor device 4 in order to attain the miniaturization by *****-izing of element-placement area. A circuit pattern (not shown) is prepared in this ceramic container 2 inside [each] cavity 2a and 2b, and after carrying cavity 2a so that the Xtal component 3 may be electrically connected with a circuit pattern to that interior, the hermetic seal of it is carried out with the lid 5.

[0012] On the other hand, after adhesives connect with a printed circuit board 6 as a semiconductor device 4 is shown in this drawing (b) for example, the circuit pattern 7 prepared in the electronic-circuitry 4' and printed circuit board 6 is electrically connected through the metal wire 8 by the wire bonding approach. At this time, in the case of wire bonding, as shown in drawing 2 , where it carried on the hot plate 9 and a printed circuit board 6 is heated, necessary thrust and ultrasonic energy are added to the metal wire 8 by the capillary tube 10.

[0013] In this case, if it should constitute so that land pattern 7' which formed the printed circuit board 6 in the rear-face side of the circuit pattern 7 prepared in the loading side of the semiconductor device 4 of a flexible sheet and its loading side might connect electrically through a through hole etc. It is possible to connect this land pattern 7' and the circuit pattern 10 prepared in cavity 2b of the ceramic container 2 using solder or electroconductive glue, and, thereby, a semiconductor device 4 will be in the condition that the flow was kept electric with the circuit pattern 10 in cavity 2b. And since the whole inferior surface of tongue will be in the condition of having been close to the hot plate in case wire-bonding connection of the semiconductor device 4 is made at this, even if a printed circuit board 6 is sheet metal, even if it compares the crystal oscillator 1 of such a configuration and it adds big thrust and ultrasonic energy, un-arranging does not have it and, so, it does not need too much heating, either.

[0014] As mentioned above, although the wire bonding approach was used for connection between a printed circuit board 6 and a semiconductor device 4 and this invention was explained, this invention is not limited to this, and it may be constituted so that a printed circuit board 6 and a semiconductor device 4 may be connected using a bump. Furthermore, since area of the printed circuit board 5 which mounted the semiconductor device 6 can be made very detailed, it can also consider this as a tape career package (tape carrier package) so that loading with a tape bonding (tape automated bonding) method may be attained at the ceramic container 1. In addition, about tape bonding and a tape career package, since it is common knowledge, explanation is omitted.

[0015] Furthermore, although this invention was explained for the printed circuit board 6 using the flexible sheet, this invention is not limited to this and may use the printed circuit board which changes from the quality of the material of a glass epoxy system, a ceramic ingredient, or others to others.

[0016] Furthermore, although the oscillator [this invention] using the Xtal component was explained to the example above, this invention is not limited to this, It is clear that you may apply to the thing using other piezoelectric transducers other than Xtal.

[0017]

[Effect of the Invention] As explained above, the piezo oscillator based on this invention Since it is

possible for there to be no un-arranging and to apply sufficient thrust even if it applies comparatively big thrust, since the symmetry which performs wire bonding for a semiconductor device since it constitutes as mentioned above is the flat-surface printed circuit board, The effectiveness that a low price and a miniaturization are attained is done so, maintaining the dependability over the impact-proof of a piezo oscillator by it becoming unnecessary to heat too much and stopping diffusion of an Au-aluminum system metal by this to the minimum.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The side-face cross-section block diagram of one example of a crystal oscillator based on this invention is shown.

(a) The cross-section block diagram of the crystal oscillator based on this invention is shown.

(b) The decomposition strabism block diagram explaining the semi-conductor loading process of a crystal oscillator based on this invention is shown.

[Drawing 2] The side elevation showing the wire bonding process of a crystal oscillator based on this invention is shown.

[Drawing 3] The cross-section block diagram of the conventional crystal oscillator is shown.

(a) The side-face cross-section block diagram of the conventional crystal oscillator is shown.

(b) The side-face cross-section block diagram explaining the semi-conductor loading process of the conventional crystal oscillator

[Description of Notations]

1,100 crystal-oscillators, 2,101 ceramic container, 2a, 2b, 101a, 101b cavity, 3,102 Xtal component, 4,103 semiconductor device, 4 'electronic-circuitry, 5,105 lid, 6 printed circuit board, 7, 10 circuit pattern, and 7' land BATAN, 8,104 metal wire, 9,106 potting resin, and 10 yes -- **, 5 printed circuit boards, 6,104 semiconductor devices, 7,105 wires, 8,106 potting resin, 9,107 hot plates, 10,108 capillary tubes, and a 109 ceramic plate

[Translation done.]